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AN EVALUATION OF DISEASES AND INSECTS IN THE DINKEY CREEK RECREATION AREA, KINGS RIVER DISTRICT, SIERRA NATIONAL FOREST

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ABSTRACT

A Forest Pest Management entomologist and plant pathologist examined the Dinkey Creek recreation area for insects, diseases and the condition of the vegetation. Organisms observed included annosus root disease, dwarf mistletoes of Jeffrey pine and white fir, the fir engraver, and the western pine beetle. The locations of these pest situations were noted on maps for District use. Pest management alternatives are provided and include 1) No change; 2) Reduce impact of annosus root disease; 3) Reduce impact of dwarf mistletoe; 4) Reduce bark beetle impact; 5) Hazardous tree management; and 6) Vegetation management. Opportunities for integrating the management alternatives are discussed.

INTRODUCTION

On September 21, 1981 John Wenz and Gregg De Nitto, Forest Pest Management Staff, met with Steve Beck, Resource Officer, and Judy Kandarian, Assistant Recreation Officer, of the Kings River District to discuss the Dinkey Creek recreation complex. At present, a heavily used, developed campground and a small summer home-tract occupies much of the area. If Dinkey Dam is constructed, part of the campground will border the lake, parts of the campground may be converted to day-use, and increased recreation activity centered around the lake is anticipated. In addition, a timber sale is scheduled for the Trails End-Rock Creek area and there are subsequent plans to construct day-use and group camp facilities in this area. On September 22-24, Wenz and De Nitto conducted a

site-by-site evaluation of the insect, disease, and vegetation conditions in the campgrounds and the Trails End-Rock Creek area. This report details our observations and discusses management alternatives intended to reduce the future impacts of pests on the vegetation.

OBSERVATIONS

The Dinkey Creek recreation complex supports an old-growth, mixed conifer stand. Stocking densities of the over- and understory vegetation are variable. Tree species include Jeffrey, sugar and lodgepole pines, white fir, incense-cedar and California black oak. Various shrubs and low-growing vegetation are scattered throughout the area. Overall, there is a good species mix, but some single species aggregates do occur.

Several insect and disease problems were observed. The insect pests included the fir engraver (Scolytus ventralis) and the roundheaded fir borer (Tetropium abietis) in white fir, and the red turpentine beetle (Dendroctonus valens) and the Jeffrey pine beetle (D. jeffreyi) in Jeffrey pine. Although not observed, pine engraver beetles (Ips spp.) occur in the area and are potential pests. The following diseases were noted: annosus root rot (Fomes annosus) in Jeffrey and sugar pine, incense-cedar, and white fir; dwarf mistletoes in Jeffrey pine (Arceuthobium campylopodum) and white fir (A. abietinum f.sp. concoloris); Armillaria root rot (Armillariella mellea) in white fir; and true mistletoes in white fir (Phoradendron bolleanum ssp. pauciflorum) and incense-cedar (P. juniperinum ssp. libocedri).

In addition to the pest organisms present, several potentially hazardous tree situations were also observed. These included top breakage of the young-growth lodgepole and Jeffrey pines, dead tops in the white fir, large basal scars (primarily old fire scars) and butt decay in white fir, and windthrow of white fir around annosus root disease centers.

As previously stated, stocking densities varied between aggregates. Stocking levels were not measured in all campgrounds, but some of the dense aggregates had basal areas up to 520 sq. ft./ac. Site quality over much of the area is high and can support substantial levels of stocking. However, overstocked conditions, even on good sites, can create stress and contribute to increased probability of attack by bark beetles, particularly when additional stresses, like drought and diseases, occur.

BIOLOGIES OF PEST ORGANISMS

Annosus root disease. Fomes annosus is a fungus that attacks a wide range of woody plants, causing a decay of the roots and lower bole and death of sapwood and cambium. All conifer species in California are susceptible to the fungus. Hardwood species are rarely damaged or killed. In some instances, madrone (Arbutus menziesii) and a few brush species, including manzanita (Arctostaphylos spp.) and sagebrush (Artemisia tridentata), are attacked. Infected pines are usually killed

rather rapidly when the fungus girdles the root collar. Older true firs and incense-cedars usually survive infection for many years, although butt and root rot may become extensive resulting in tree weakening and windthrow.

During periods favorable to the fungus, fruiting bodies form in decayed stumps, under the bark of dead trees, or in the duff at the root collar. The fungus becomes established in freshly cut stumps from airborne spores produced by the conks, and then grows into the root system. True fir can also be infected by spores invading live roots and fresh basal wounds. The fungus subsequently spreads to healthy roots of surrounding susceptible tree species via root contacts. In general, infections will cross from pine to true firs; however, rarely is the fungus observed to go from true fir to pine. Local spread of the fungus outward from a stump typically results in the formation of disease centers, with dead trees in the center and fading trees on the margin. These centers usually continue to enlarge until they reach barriers such as openings or groups of nonsusceptible plants.

The fungus may remain alive for as long as 50 years as a saprophyte in infected roots and stumps. Young susceptible tree species often become infected and die after their roots contact old infected root systems in the soil.

Dwarf mistletoe. Dwarf mistletoes are parasitic seed plants that require living host tissue to survive. Each species has a limited host range that is usually confined to one or two commercial conifer species.

Dwarf mistletoes are major causes of growth loss and reduced vigor and can be mortality factors, especially in a complex with bark beetles and drought. They can also form large witches' brooms in tree crowns, especially pines, and large bole cankers, principally in true firs.

Mature seeds are usually produced in late summer and fall and are forcibly ejected from the fruit. They are covered by a sticky, gelatinous coating and adhere on contact. The seeds germinate in the spring and infect twigs less than two-years-old near the needle base. In two to three years, shoots appear and these produce fruit in another two to three years. The infection in the branch can survive as long as the host tissue is alive.

Spread of dwarf mistletoe is relatively slow. Individual seeds are usually shot a horizontal distance of 15 to 20 feet, although infections high in crowns may send seeds over 100 feet when assisted by wind. However, horizontal spread in an even-aged pine stand averages one to two feet per year with a vertical spread rate up the crown at about four inches per year. In true fir stands, the average horizontal spread rate is similar, but the vertical spread is somewhat less at three inches annually.

Fir engraver. Scolytus ventralis (Scolytidae) can attack most true firs in the West, including white fir. Successful attack by the fir engraver can result in a) tree mortality, b) top-kill, or c) patch kill along the bole. The adults fly and attack trees between June and September, but

fading of the foliage often does not occur until the following spring. The fir engraver will attack trees ranging from pole-size to over-mature dominants. Attacks are characterized by boring dust in bark crevices and pitch streamers on the mid- and upperbole. Obvious pitch tubes, that often are evidence of attack by Dendroctonus species, are not formed. The fir engraver takes from 1 to 2 years to complete a generation.

Roundheaded fir borer. In contrast to S. ventralis, which can kill "healthy" green trees, the roundheaded fir borer, Tetropium abietis (Cerambycidae), is generally considered to be a "secondary". That is, it attacks true firs that have been weakened or are dying from other causes. T. abietis is frequently found in trees that have been attacked and top-killed by the fir engraver. Under such circumstances, they may hasten the death of the tree, but they can also infest a host without killing it. Their presence is characterized by large, winding larval galleries in the inner bark and/or wood that are packed with coarse boring dust. Adults fly from June to August and there is one generation per year.

Jeffrey pine beetle. Dendroctonus jeffreyi (Scolytidae) attacks only Jeffrey pine and, different from the fir engraver, a successful attack always results in the death of the host tree. The adults fly and attack green trees from June to October. Characteristic pitch tubes are often formed on the bole at the point of attack, but the foliage tends to fade slowly and infested trees may not be detected until the spring or early summer of the year following attack. High-level D. jeffreyi activity is often typified by mortality occurring in large groups of 20 to 30 trees of varying ages. Under such conditions, trees can be successfully attacked regardless of vigor, as healthy trees may be overcome by large numbers of attacking beetles. Low-level, "normal" Jeffrey pine beetle activity is characterized by mortality occuring in scattered, slow-growing individual trees or small, 2 to 3 tree groups that have been predisposed by such factors as root diseases, heavy dwarf mistletoe infection, overstocking and drought. D. jeffreyi does not breed in slash.

Red turpentine beetle. D. valens (Scolytidae) can attack several species of pine, including Jeffrey, lodgepole and sugar pines. Under "normal" conditions it confines its attack to the lower 3 feet of the bole and the root crown, is often restricted to one panel or 1/4 to 1/2 of the bole circumference, and does not kill the host tree. However, when trees are under stress and weak, such as during a drought, attacks may occur 15 feet up the bole and larval tunneling can be found around the majority of the tree circumference. Under such conditions, D. valens can be the immediate cause of death. Large, reddish pitch tubes near the base of the tree indicate successful red turpentine beetle attack.

Pine engravers. Although not currently active in the areas evaluated, Ips spp. are present in the area and should be considered as they have the potential to affect management of the area. Pine engravers can breed in the tops of living pines and in fresh green slash. They have the potential in the Dinkey Creek area to go through 2 to 3 generations

in one year. Attacks on live trees are generally limited to trees that are stressed by such factors as root disease, heavy dwarf mistletoe infection, drought, fire, or attack by other bark beetles. Serious top-killing of green trees often occurs when fresh green slash is available in the spring, allowing populations to build-up and attack nearby standing trees during the summer. The top-killed pines may be more susceptible to subsequent attack by Dendroctonus spp.

PEST MANAGEMENT ALTERNATIVES

1. No Change in Current Management Direction. Present management practices, primarily salvage and removal of hazard trees, would continue. No additional vegetation management activity would be initiated and no measures to reduce insect and disease impacts would be implemented. Tree mortality and top-kill would continue at present levels, given "normal" weather conditions, at least in the short-term. Bark beetles would be the immediate cause of mortality and top-kill. Increased mortality would be expected if drought conditions occur. Individual tree mortality would occur around the margins of annosus root disease centers and windthrow of green trees might take place, especially of white fir. Intensification and spread of dwarf mistleoe in the white fir and Jeffrey pine would continue. The Jeffrey pine would be most severely affected in areas where present infection levels are severe and spread to surrounding trees is possible (e.g., east side of Loop E). The dwarf mistletoe in white fir could become significant in the understory where stocking is heavy and infected overstory is present. Thus, the several factors that tend to weaken and predispose trees to bark beetle attack would tend to increase and, in the long run, bark beetle-related mortality and top-kill would be expected to increase.

2. Reduce Impact of Annosus Root Disease. Preventing the initiation of annosus root disease centers is the most effective method of control. This can be easily accomplished by the application of borax (sodium tetraborate decahydrate, EPA Reg. No. 1624-94) to freshly cut conifer stumps according to label directions (see FSM 2331.33, R-5 Suppl.). A copy of the label and names of local distributors are included.

To reduce the impact of existing root disease centers, species conversions are necessary. Within infection centers in true fir, only fir are expected to be affected. Therefore, maintaining and planting species other than fir will revegetate the center and possibly reduce the spread by interfering with fir root contacts. Thinning of fir stands around the margin of root disease centers may promote the vigor of residual firs and possibly result in the growth of more roots than are lost to decay.

Within infection centers in pine, fewer species options are available for regeneration. Only hardwood trees and shrubs should be maintained or planted in these centers. Again, thinning around the margins may reduce the impact to white firs, but the pines probably would not benefit.

3. Reduce Impact of Dwarf Mistletoe.

a. In Fir. The infection levels in areas with dwarf mistletoe-infected white fir are low. By maintaining a vigorously growing stand, it is expected that this pathogen will have minimal effect. This can be accomplished through thinnings that discriminate against less desirable and more heavily infected individuals. In addition to thinning, promoting a species mix will reduce horizontal spread of dwarf mistletoe in the stand. Protection of noninfested stands or parts of stands is accomplished by preventing the introduction of dwarf mistletoe seed. Stands treated for dwarf mistletoe should likewise be protected from reintroduction of the pathogen. This can be accomplished by having the noninfested areas surrounded by buffers, at least 100 feet wide, that do not have host plants. To minimize stand and site disruption, naturally-occurring buffers, such as meadows, timber type changes, streams and lakes, etc., should be employed by limiting or expanding the size of the area of concern when possible. Existing man-made buffers, such as rights-of-ways, roads, parking lots, etc., can also be incorporated into the buffer system. If it is not possible to utilize existing potential buffers, then a 100 feet wide strip without host plants should be constructed around noninfested stands to protect them.

In the northwestern corner of the Trails End Resort area are two localized white fir dwarf mistletoe infection centers. Because of the isolated nature of these infestations, attempts could be taken to eradicate the pathogen from these parts of the stand. The most effective method is to remove all white fir in and around the infested areas. A second alternative is to remove all visibly infected trees every two years for a six year period. This might result in the retention of some uninfected white fir, however, there is a greater risk of not eradicating the dwarf mistletoe. Of course, a third alternative for these areas would be to treat them similarly to other areas, as described in the preceding paragraph, and manage the stands to tolerate the pathogen.

b. In Pine. Dwarf mistletoe in Jeffrey pine may have a more significant impact than in white fir. Different treatments are available depending on the desired outcome for the stand. Regardless of the treatment selected, all heavily infected trees should be removed because of their production of dwarf mistletoe seed and the likelihood of their death. Spread of dwarf mistletoe into healthy stands should be limited by separating them from infested areas. This can be accomplished by incorporating 100 feet wide buffers that are devoid of the host plants between the noninfested and infested areas.

If retention of the overstory is desired, then understory pines should be removed and stocking levels adjusted to reduce competition. The vigor of individual Jeffrey pines with witches' brooms in the lower crowns could be inceased by pruning the trees to remove the brooms. At least 30% live crown must be retained and no more than one-half of the green crown should be removed. Removal of all infected branches is not necessary, but branches interspersed with the witches'-brooms should be removed to reduce crown raggedness.

If it is desired to reduce the amounts of dwarf mistletoe in the future stand, then removal of infected overstory trees is necessary. The pine understory should then be treated to improve its growth and eliminate the heavily infected individuals. Non-host trees and shrubs should be encouraged in the area to provide adequate vegetation; this may mean artificial regeneration. However, care should be taken not to plant susceptible host species in annosus root diseases centers.

4. Reduce Bark Beetle Impact. There are basically two bark beetle management alternatives currently available: 1) mitigation of predisposing conditions or factors and 2) individual tree protection. Bark beetle problems are often associated with trees/stands that have been weakened or stressed by some predisposing agent or condition. Important predisposing factors noted in the Dinkey Creek area included annosus root disease, dwarf mistletoe and overstocking. From the standpoint of preventing pine engraver problems, proper slash management practices, particularly in the spring and early summer, are critical. The management alternatives discussed above relative to F. annosus and dwarf mistletoe coupled with regulation of stocking levels and species composition on an aggregation by aggregation basis should reduce bark beetle-related damage. Vegetation management that results in healthy, vigorous stands should also reduce the impacts of non-manageable factors like drought. Long-term bark beetle-related losses cannot be significantly reduced without alleviating the predisposing factors.

Individual tree protection might be considered in situations where high value pine trees are under severe temporary stress (thus predisposing them to bark beetle attack) from a factor(s) or condition(s) that will diminish in a relatively short time and from which the trees can reasonably be expected to recover. One example would be trees scorched, but not killed, by fire. Another example might be trees damaged (bole wounds, injured or severed roots) during road maintenance or construction, or construction of day-use or group campground facilities. Under such conditions, treating the bole of the high value trees during the "susceptible" period with an insecticide to prevent successful bark beetle attack may be warranted. Currently, Sevimol 4 carbaryl insecticide is registered as a preventive treatment for pines against the mountain and western pine beetles.

5. Hazardous Tree Management. Identifying trees that are hazardous requires knowledge of the species, their defects and resulting probability of failure, and the local environmental conditions. Management of hazardous trees implies implementation of a continuous program of surveillance and identification, followed, as appropriate, by taking action to eliminate or minimize the potentially hazardous situations. Such a program would also include a formal record-keeping system and periodic hazardous tree detection surveys.

In addition to reducing the potential impact of existing hazardous trees, efforts must be made to minimize the creation of new hazardous trees. This is especially important during any operation in the recreation area, especially tree falling and construction. Injury to residual trees must be minimized, especially basal wounding of white fir. For particularly valuable trees, special precautions may be warranted.

If a residual tree is significantly injured, it may be appropriate to remove that tree while operations are occurring rather than have it increase in hazard potential with time.

6. Vegetation Management. The development of a long-term vegetation management plan requires an interdisciplinary approach that examines the present and future vegetation with the intent of meeting recreation, aesthetic and other objectives through the incorporation of silvicultural, pest management and other local concerns in management prescriptions. Implementation of a vegetation management plan can reduce the future levels of mortality, even during adverse conditions, and can improve the vigor of residual vegetation thus lessening the future impact of pests. After establishing management objectives for the recreation area, the actual vegetation manipulation should be planned on an individual aggregation basis.

In the Dinkey Creek recreation complex such a plan should encourage the maintenance of an all-aged, mixed species stand at proper stocking levels with understory shrubs. This will provide the greatest diversity to reduce future impacts of pests. Integration of the previously discussed pest management techniques into the vegetation management plan would reduce pest impact, as well as provide for a healthier, more vigorous stand.

If you have any questions about this evaluation or require additional information or assistance please contact the FPM Staff.

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Local farm chemical companies probably also have access to this chemical.

BORAX FOR FOMES ANNOSUS CONTROL

ACTIVE INGREDIENT:

Sodium Tetraborate Decahydrate.....($Na_2B_4O_7.10H_2O$).... 100.00%

[Boric Oxide (B_2O_3) Equivalent.....37.50%]

FOR CONTROL OF FOMES ANNOSUS IN PINE AND FIR STANDS

It has been established that the fungus, Fomes annosus, often infects cut conifer stumps following thinning or cutting operations, and that the fungus can spread from infected stumps to residual trees in the stand.

Several chemical agents have been used to limit the development of Fomes annosus. Research has shown that Borax prevents establishment and growth of Fomes annosus in cut stumps of pine and fir. Borax, a granular, technical chemical, is widely available from distributors of industrial chemicals. It offers a low-cost, convenient, and safe method of limiting losses to Fomes annosus.

Before using Borax for stump treatment control of Fomes annosus infection, contact local, State or Federal Forest Service authorities to verify most economical and efficient methods and materials for your situation.

DIRECTIONS FOR USE

Use of Borax for this purpose is limited to pines in the Eastern States; in California and adjacent areas of Nevada, to pines, true firs, and associated conifers occuring in the stand being treated.

Borax should be applied to stump surface of the cut tree as soon after felling as practicable. For most efficient use, apply immediately after cutting but do not delay treatment more than two days.

Best method of application is to sprinkle material "salt-shaker" style on the freshly cut stump surface. Complete coverage, including exposed side areas and any splinters, is necessary. "Shaker-top" applicators are available in most farm and garden shops in one or two-pound sizes.

Apply only enough Borax to lightly cover stump surface. At proper rates of application, one pound of granular Borax will adequately cover 50 square feet of stump surface; that is, 260 six-inch stumps, 158 eight-inch stumps, 80 ten-inch stumps, or 60 twelve-inch stumps.

Moisture in the exposed wood from freshly cut stumps, dew, or rain, will dissolve the Borax and leach it into the wood.

CAUTION: KEEP OUT OF REACH OF CHILDREN

CAUTION: Use care and caution in handling and applying all pesticides. May be harmful if swallowed. Follow directions and do not over apply, waste or spill. Do not store pesticides with feed or foodstuffs, or where children or animals may have access. Destroy all containers when empty. Multiwall paper containers in which Borax is packed may be burned when empty. Wash hands, face, and clothing after use.

Borax carelessly spilled or applied to cropland or growing plants — including trees and shrubs — may kill or seriously retard plant growth. Do not contaminate any body of water by direct application.

NOTICE

Because of many varying conditions affecting use and application, such as location, seasonal weather, soil composition and type of vegetation, manufacturer warns buyer that these and other conditions may impair or vary the results or effects of this product. In any event, complete elimination of Fomes annosus is not guaranteed. Neither manufacturer nor seller shall be liable in respect to any injury or damage suffered by reason of the use of this product for a purpose not indicated by the label or when used contrary to the directions or instructions hereon nor with respect to breach of any warranty not expressly specified herein. Buyer accepts this material subject to these terms, and assumes all risk of usage and handling except when used or handled in accordance with this label. Neither manufacturer nor seller makes, and their employees, and agents are not permitted to make, any representations or warranties, express or implied by law, not specifically set forth herein.

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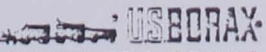

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